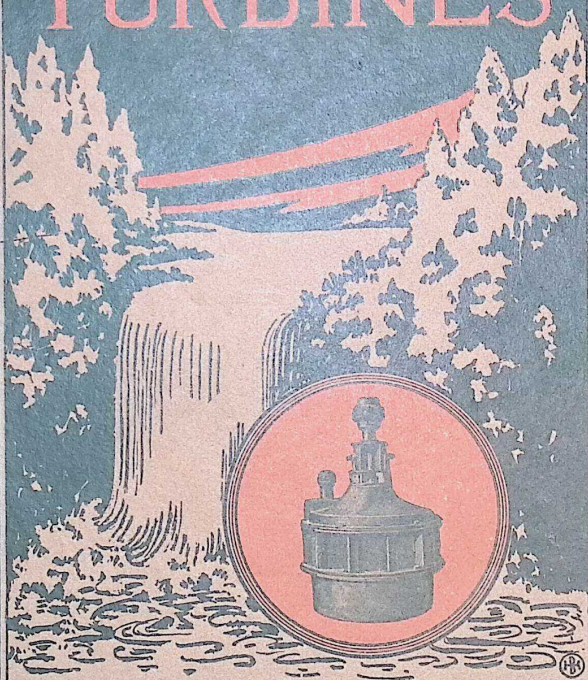


CMC TURBINES



CHRISTIANA MACHINE COMPANY
CHRISTIANA, PENNA.

D-122 202

Established
1830



Incorporated
1902

HYDRAULIC TURBINES

MANUFACTURED BY

CHRISTIANA MACHINE COMPANY

CHRISTIANA, PENNA., U. S. A.

CATALOG 307

ENGINEERS, FOUNDERS, MACHINISTS

and

MANUFACTURERS OF

GEARS, SPROCKETS, PULLEYS,

WORMS AND WORM GEARS

PRODUCTS

MANUFACTURED BY

CHRISTIANA MACHINE COMPANY.

CUT TOOTH GEARS.

SPUR, BEVEL AND MITER MORTISE GEARS.

HARDWOOD MAPLE AND HICKORY COGS.

SPUR, BEVEL AND MITER CAST TOOTH GEARS.

CAST IRON PULLEYS. SPROCKETS.

BROOMELL PRETZEL ROLLING MACHINE.

MANHOLE FRAMES AND COVERS—SEWER INLETS.

SPECIAL MACHINERY.

FOREWORD

The increasing cost of coal as a source of power is turning attention every year more forcefully to the use of water power. The harnessing of the vast potential energy of our streams and rivers offers the most effective source of relief from this burdensome cost. Progressive factory managers are beginning to realize this fact and are taking steps to cut down their production costs by this method.

The Hydraulic Turbine has become accepted as the standard machine for utilizing water power. It is simple, reliable and economical, and can be depended upon to develop power year after year at a minimum expense. Fortunate is the mill or plant that can use a Hydraulic Turbine, for it has an incalculable advantage over the factory that is less favorably situated. There is scarcely a stream too small to develop some measure of power.

We have been making Hydraulic Turbines for more than forty years. During that time we have studied their operation in actual use and have incorporated in their design every worthwhile improvement that experience could recommend. C. M. C. Turbines have been tested at the Holyoke Flume of the Holyoke Water Power Company, Holyoke, Mass., where official Government tests are made, and all ratings are based upon the results of these tests.

In workmanship and material, C. M. C. Hydraulic Turbines are every thing that modern machinery and skilled labor can produce. Their record of performance, backed by a company with the experience of years, makes them the logical choice for efficient and dependable service.

Christiana Machine Company

Christiana, Penn., U. S. A.

IMPROVING WATER POWER

In developing or improving a water power the first thing necessary is to know the amount of head that can be or is secured. The terms "head" and "fall," as commonly used, may be considered as synonymous, and either expresses the meaning intended, which is the vertical distance from the surface of the tail water to the surface of the head water. Where the works are already constructed this is easily found by careful measurement, but to ascertain the fall in an undeveloped stream a system of leveling will be necessary.

The working head, or that which exists when the Turbine is running, is all that is effectual, and it is this that should be measured, or a proper allowance made from the standing head.

Water has power according to the distance it falls, and the effect on a Turbine is that due to its weight in falling from a higher to a lower level.

Anything, therefore, that can be done to secure as much standing head as possible and to maintain the working head nearly at the same level is in the highest degree important. Two things are requisite for the latter purpose—a wide and deep head race and forebay to supply the water to the Turbine and a tail race of similar character that will not cause the water to back up against the Turbine, with plenty of clearance in the pit under the wheel.

THE HEAD RACE

It is important that the head race be constructed sufficiently deep and wide to give it capacity enough to prevent the loss of head after the Turbine has been running for some hours. This is especially necessary when the race is of considerable length and a large volume of water is to pass through.

Head water should not flow faster than 60 to 120 feet per minute. When iron or steel piping is used to convey the water to the Turbine, the receiving end of the supply pipe should be sufficiently below the surface of the head water to prevent any

possibility of drawing air. The velocity of the water through the supply pipe should not exceed 180 feet per minute in short lengths, and in long pipes of 250 feet or more the velocity should not be greater than 120 feet per minute.

SIZES OF WATER WAYS

To determine the sizes of the head and tail races, use the following rule:

Divide the number of cubic feet of water to be used by 85, and the quotient will be the area in square feet required in the cross section of the passages.

For example, one 48-inch C. M. C. Turbine under 12-foot head will discharge 4458 cubic feet of water per minute. This number divided by 85 gives a quotient of 52.4, so that the head race and other passages should be about 13 feet wide and 4 feet deep, or an equivalent cross-section in other proportions. If it is impractical to make a deep tail race the entire length, it is at least very essential that the pit under the Turbine complies with the given rules and that its depth should not be less than that shown in the table of measurements on page 25. The tail race should be lined with some material that will prevent washing or injury to foundations.

THE TAIL RACE

The correct construction of the tail race is equally as important as the proper construction of the head race.

The tail race should be made wide and its bed sufficiently below the surface of the stream into which it empties to permit three or four feet of dead water to stand in its entire length when the Turbine is not in operation. This will permit the water discharging into the tail race from the Turbine to pass away freely with very little rise in its surface.

Since the working head of the Turbine is decreased exactly by the amount of rise in the tail race, the importance of a tail race of sufficient capacity cannot be over emphasized.

THE WHEEL PIT

The Wheel Pit is the pit under the Turbine into which the water is discharged. Especially under low heads the Wheel Pit should always be deep and wide. Foaming and dashing of the water in the Wheel Pit is a sure sign that the pit is either too shallow or too narrow, or both.

To properly construct this pit the depths given on page 25 should be used.

PENSTOCK AND SUGGESTIONS FOR SETTING TURBINE

The chamber in which the Turbine is set is called the Penstock. It can be made of wood, steel or concrete, be open at the top or closed, according to conditions. If open, it must have walls higher than the head water in the flume or in the head race. If closed, it can be placed below the flume or head water and must be absolutely tight on the top as well as the sides and bottom.

To assure a tight joint at the opening through which the draft tube of the Turbine extends, it is well to make a gasket of soft wood to place on the floor around the hole, so that when bolted down the Turbine will compress the gasket and make it conform to the unevenness of the floor.

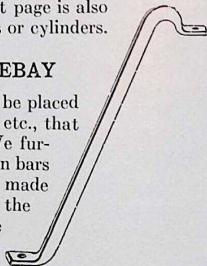
It is important that the Penstock be built on a good foundation, because it must carry not only its own weight but also the weight of the water and the Turbine and sometimes heavy gearing or pulleys.

To insure against sagging, a good plan is to support the timbers around the Turbine opening with two or more posts.

The correct size Penstock for the various sizes of C. M. C. Turbines will be found on page 25; on that page is also listed the dimensions of the draft tubes or cylinders.

RACK IN FOREBAY

In the use of turbines a rack should be placed across the forebay to arrest driftwood, etc., that is liable to come down the stream. We furnish, for this purpose, when ordered, iron bars of the form shown in the cut. A rack made of these bars is very easily cleaned as the curve at the top allows the rake to be drawn off without interference.



These racks should be placed as close together as the free passage of water will allow. Iron bars are preferable to wooden ones because they can be made much thinner, thus presenting less obstruction to the water. Care must be taken that the head is not allowed to fall off by the rack becoming clogged. A good plan is to have a coarse rack located farther up stream to catch the larger drift. This will make the necessity for cleaning less frequent.

DRAFT TUBES

It is often convenient, especially in using a Turbine under a high head, to place it some distance above the tail water and use a draft tube.

All Turbines on horizontal shafts require draft tubes of sufficient length to keep the pulleys or gears on the shaft, well above the highest rise of the tail water.

These tubes should be made of iron, steel or concrete and should be perfectly air-tight and secured to the case of the Turbine with an air-tight joint. They can be safely used up to a length of ten to fifteen feet, but it is advisable to keep them as short as possible. The lower end should extend a few inches below the surface of standing tail water.

All C. M. C. standard vertical Turbines, Style No. 1, are made with a short tube or cylinder, so that the lower timbers of the Penstock may be kept just above the tail water. When greater length of tube is required a flange is made on the lower end of the cylinder to which it may be attached. For short additions the cylinder is made longer.

Vertical Turbines in Globe Cases, Style No. 2, may be fitted with draft tubes, or installed by submerging the bottom of the globe case a few inches below the surface of the standing tail water.

Provision is made on all C. M. C. horizontal Turbine cases for the attachment of a draft tube and supply pipe. We are prepared to furnish these pipes and connecting flanges in any sizes or lengths required, or the connecting flanges separately if wanted.

MEASUREMENT OF WATER

In all cases where it is necessary to use water economically the amount available, if not already known, should be ascertained by one of the various methods used for that purpose.

Where large interests are at stake or the conditions make the problem difficult it is advisable to secure the aid of some one well versed in hydraulics.



MEASURING SMALL STREAMS BY A WEIR

The best method of measuring small streams is by the use of a weir. This should be constructed as illustrated on page 8. Procure a plank of sufficient length to reach across the stream with its ends embedded in the banks. If the plank is of sufficient width, cut a notch in it deep enough to pass all the water and long enough to reach about two-thirds across the stream. If it is too narrow for this, make the notch by securing pieces to it at the ends with cleats. The bottom and ends of the notch should be beveled leaving the edge nearly sharp on the up-stream side. The bottom must be straight and placed level across the stream and not less than eight or ten inches above the level of the water on the lower side. Care must be taken to close all crevices below the board and at the ends so that all the water will pass over the crest of the weir.

To correctly measure the depth of the water, a post E should be driven in the bed of the stream three or four feet above the board, and its top made level with the crest B as indicated by the dotted line D.

If the water rises above the crest and post before this level is secured, use two stakes of equal length, one on the post and the other on the crest, and drive the post down until the tops of these are level with each other. When the water has risen to its greatest height and all is passing over the weir, measure the depth of it over the top of the post as indicated by the line C. This is the true depth and is that used in the calculation of weir tables. If the depth be measured on the crest of the weir it will be found to be less, owing to the curve of the top of the water.

Having ascertained this depth, the amount of water may be determined by use of the weir table on page 21. Find in the left-hand column the number of inches and at the top the fraction of an inch (if any) corresponding to the depth as measured on the post, and in the body of the table opposite there will be found the number of cubic feet per minute for each inch of length of weir (or width of overflow). Multiply this number by the number of inches in length of weir and the result is the number of cubic feet per minute flowing in the stream.

In determining the size of Turbine to be used, the storage pond will, of course, be an important factor, unless the Turbine is to run constantly.

If, for instance, the Turbine is to run only twelve hours a day and the capacity of the pond is sufficient to retain all the water that flows into it during the remaining twelve hours, it is evident that a Turbine may be used that will discharge twice the amount of water per minute that flows into the pond.

If the water power is already developed and a new Turbine is to be installed that is to use the same amount of water as the old one, it is sometimes convenient to measure it by placing a weir across the tail race.

MEASUREMENT OF LARGE STREAMS

Frequently it is impracticable to construct a weir on account of the size of the stream. To measure the water in such cases a simple method is to ascertain the area of the cross-section of the stream and multiply it by the average velocity.

If correct data could be had the result would, of course, be absolutely correct. By observing the following suggestions measurements may be taken that will be approximately correct and sufficient for practical purposes.

Select a portion of the stream that is nearest uniform in width and depth and free from short curves. Measure the depth at several equally distant points across the stream making the space between the bank on either side and the first point half as much as each of the other spaces. Add together all the depths taken and divide their sum by their number for the average depth. Multiply this result by the width and the product will be the area of the cross-section in square feet.

Owing to the friction of the water on the bed of a stream the velocity is greatest at the surface and near the center of the stream. It has been determined by careful experiment that the average velocity is about 80 per cent of that at the central surface.

Bearing this in mind the average velocity may be estimated by throwing a body into the stream having nearly the same specific gravity or weight as the water. A block of heavy wood, that will sink nearly to a level with the water, will serve the purpose. Keep it near the middle of the stream and ascertain the rate of flow by noting the distance it passes in a definite time, and convert the distance and time into rate per minute. Take 80 per cent of this as the average rate and multiply by the number of square feet in the cross section as before found and the product will be the number of cubic feet flowing in the stream per minute.

SIZE OF TURBINE REQUIRED

Having found the amount of water and the head under which the Turbine will work, consult the tables on pages 30 to 33. At the top will be found the number of feet of head. Passing down the column find the number of cubic feet nearest to that of the stream and just above is the amount of horse-power that can be obtained, and below is given the revolutions per minute, while in the left-hand column, opposite these, the size of the Turbine is listed.

Definition of Terms will be found on page 20.

If you desire our advice in the selection of a Turbine, kindly send for questionnaire sheet which will enable our engineering department to recommend the size and style Turbine best suited for your purpose.

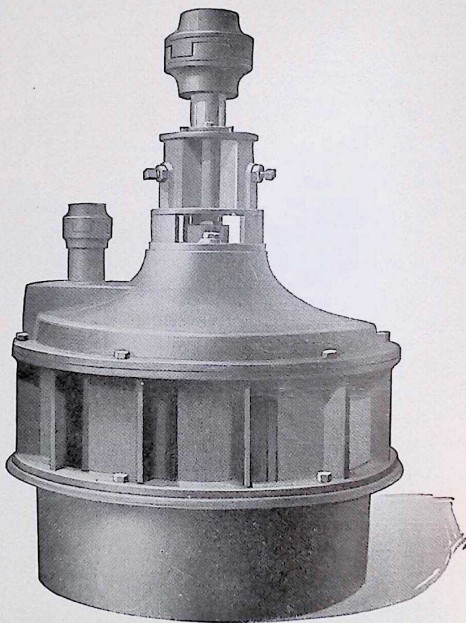


FIG. 1

C. M. C. TURBINE WATER WHEEL

REGISTER GATE, VERTICAL TYPE

STYLE NO. 1

STYLE NO. 1

C. M. C. Vertical Turbine

The C. M. C. Turbine is of the type known as Register Gate. The Vertical Turbine is the most widely used model that we manufacture. Its popularity is due to its wide range of adaptability. It is the most economical to purchase and to install.

The Vertical Turbine can be used wherever it is possible to build an open or enclosed penstock and where the power can be taken from a vertical shaft.

Two rings, one of which rotates through a small section of a circle within the other, have corresponding openings, which, when they register, form chutes that conduct the water to the runner in a direction tangent to its radius or nearly so.

In Style No. 1 the inside ring is the movable and hence is called the gate, although, being deeper, it contains the greater portion of the chutes and is sometimes called the chute ring.

The gate is opened and closed by means of a strong and simple device placed between the gate and the cap, and consists of a heavy tooth spur pinion meshing into a segment of the gate arm that distributes the force by means of two operating arms to opposite sides of the gate.

These features are shown in the line cuts on pages 18 and 19. The steps of these wheels are made of lignum-vitae.

A table giving the sizes of the openings to be cut in the bottom of the penstock to receive vertical turbines will be found on page 25, headed "Diameter of Cylinder on Wheel Cases."

SIZES OF STYLE NO. 1 TURBINES

Style No. 1 C. M. C. Hydraulic Turbines are manufactured in the following sizes. These sizes are determined by the diameter of the top of the runner.

6 in.	14 in.	24 in.	36 in.
8 in.	16 in.	27 in.	42 in.
10 in.	18 in.	30 in.	48 in.
12 in.	21 in.	33 in.	54 in.
			60 in.

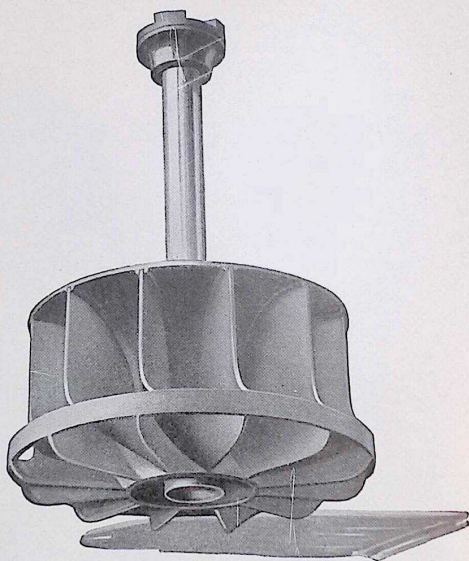


FIG. 2

THE RUNNER
FITTED WITH SHAFT AND HALF OF
COUPLING

THE RUNNER

The hub, the blades and the runner band are practically one piece. The blades although cast separately are later placed in the mould and the hub cast in their center which deeply embeds the blades. A wrought iron band is then shrunk on the lower portion of the runner binding the blades together and making all parts integral. This band is then turned true and the runner balanced.

Runners for Turbines 6" and 8" in diameter are cast in one piece, the buckets being formed by cores. These small runners are equally as efficient and well balanced as the larger ones.

The C. M. C. Runner is larger in diameter at the bottom than at the top. When in position the bottom section extends out under the gate ring, protecting the band from foreign substances such as leaves, grass, etc., thus eliminating the possibility of the runner becoming clogged. This extension feature can be seen on the opposite page, Figure 2, and on page 18, Figure 3.

This runner adds to the capacity of the C. M. C. Turbine because the diameter as listed is that of the top of the runner.

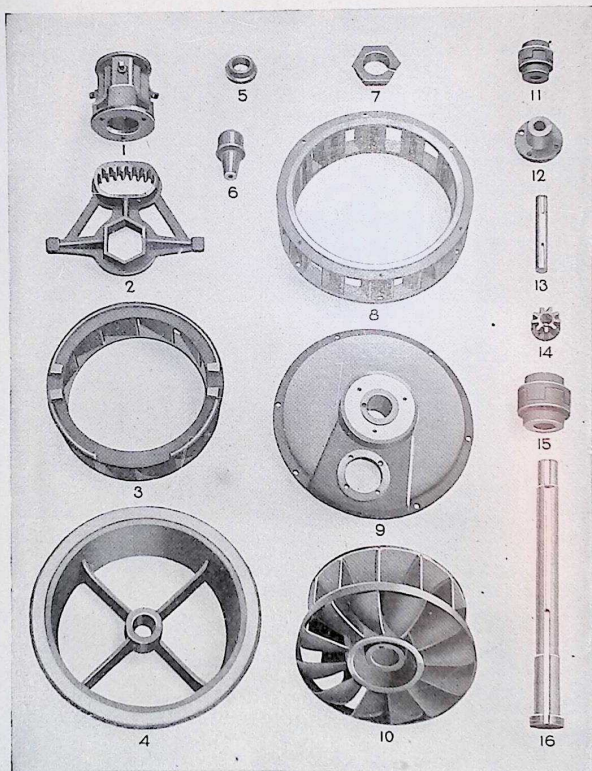
The runner hub is of the concave or bell-shaped type. The water acting against it has a lifting tendency thus reducing the friction on the step bearing.

The step is made of Lignum-Vitae, spherical at the top where the concave bottom of the main shaft fits.

This form of bearing will operate for years without any perceptible wear.

The design of the C. M. C. Runner is one of the features that makes the C. M. C. Turbine so highly efficient as has been shown by the tests made at the Holyoke Flume.

Turbines that are to operate under very high heads are made with special bronze runners, balanced to the last degree of accuracy.



PARTS

On the opposite page are illustrated the various parts that comprise the Style No. 1 Vertical C. M. C. Turbine. In ordering please specify by number, as well as by name, the parts required, and also the size Turbine for which they are intended.

1. Follower Box (Complete).
2. Gate Operating Arm.
3. Gate or Chute Ring.
4. Cylinder or Spider.
5. Splash Ring.
6. Lignum-Vitae Step.
7. Gate Operating Arm Nut.
8. Curb.
9. Cap.
10. Runner.
11. Gate Coupling (Upper and Lower Halves).
12. Gate Shaft Housing.
13. Gate Operating Shaft.
14. Gate Pinion.
15. Main Shaft Coupling (Upper and Lower Halves).
16. Main Shaft.

Drawings showing assembly of these parts will be found on pages 18 and 19.

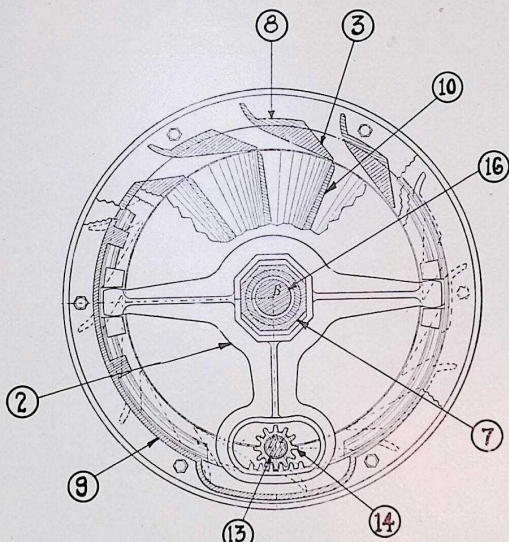


FIG. 4

List of parts illustrated on page 16.

- | | |
|----------------------------|---------------------------|
| 2. Gate Operating Arm. | 9. Cap. |
| 3. Gate or Chute Ring. | 10. Runner. |
| 7. Gate Operating Arm Nut. | 13. Gate Operating Shaft. |
| 8. Curb. | 14. Gate Pinion. |
| | 16. Main Shaft. |

DEFINITION OF TERMS

Hydraulic Turbine and Turbine Water Wheel:

These terms as generally used are synonymous.

Head Race:

The channel for conducting the water to the penstock, forebay or supply pipe from the source of supply.

Head Water:

The water in the penstock or in the dam.

Supply Pipe:

Conducts water from the dam, race or forebay to the penstock or direct to the Turbine if the Turbine is of the encased type.

Forebay:

Open storage reservoir between head race and penstock.

Flume:

Applies generally to wood, steel or concrete water way connecting head race and penstock.

Penstock:

The chamber that is filled with water and in which the Turbine is set.

Draft Tube:

The discharge pipe between the Turbine and the wheel pit.

Wheel Pit:

The pit under the Turbine into which the water is discharged.

Tail Race:

Water way for carrying off the discharged water from the Turbine.

TABLE GIVING CUBIC FEET OF WATER PER MINUTE
THAT WILL FLOW OVER A WEIR ONE INCH WIDE
AND FROM $\frac{1}{8}$ TO $24\frac{7}{8}$ INCHES DEEP

INCHES		$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
0	.00	.01	.05	.09	.14	.19	.26	.32
1	.40	.47	.55	.64	.73	.82	.92	1.02
2	1.13	1.23	1.35	1.46	1.58	1.70	1.82	1.95
3	2.07	2.21	2.34	2.48	2.61	2.76	2.90	3.05
4	3.20	3.35	3.50	3.66	3.81	3.97	4.14	4.30
5	4.47	4.64	4.81	4.98	5.15	5.33	5.51	5.69
6	5.87	6.06	6.25	6.44	6.62	6.82	7.01	7.21
7	7.40	7.60	7.80	8.01	8.21	8.42	8.63	8.83
8	9.05	9.26	9.47	9.69	9.91	10.13	10.35	10.57
9	10.80	11.02	11.25	11.48	11.71	11.94	12.17	12.41
10	12.64	12.88	13.12	13.36	13.60	13.85	14.09	14.34
11	14.59	14.84	15.09	15.34	15.59	15.85	16.11	16.36
12	16.62	16.88	17.15	17.41	17.67	17.94	18.21	18.47
13	18.74	19.01	19.29	19.56	19.84	20.11	20.39	20.67
14	20.95	21.23	21.51	21.80	22.08	22.37	22.65	22.94
15	23.23	23.52	23.82	24.11	24.40	24.70	25.00	25.30
16	25.60	25.90	26.20	26.50	26.80	27.11	27.42	27.72
17	28.03	28.34	28.65	28.97	29.28	29.59	29.91	30.22
18	30.54	30.86	31.18	31.50	31.82	32.15	32.47	32.80
19	33.12	33.45	33.78	34.11	34.44	34.77	35.10	35.44
20	35.77	36.11	36.45	36.78	37.12	37.46	37.80	38.15
21	38.49	38.83	39.18	39.53	39.87	40.22	40.57	40.92
22	41.27	41.62	41.98	42.33	42.69	43.04	43.40	43.76
23	44.12	44.48	44.84	45.20	45.56	45.93	46.29	46.66
24	47.03	47.39	47.76	48.13	48.50	48.87	49.24	49.62

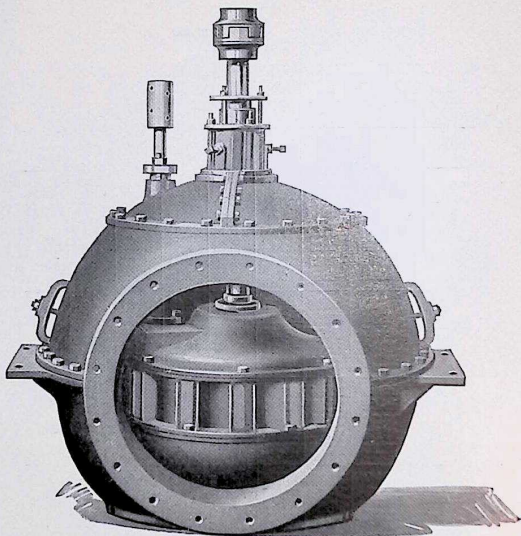


FIG. 5

C. M. C.
ENCASED VERTICAL TURBINE
REGISTER GATE
STYLE NO. 2

STYLE NO. 2

Generally where a Vertical Turbine is to operate under a high head, the most practical method is to conduct the water by means of a supply pipe to an enclosed Turbine as shown on the opposite page. Style No. 2 Turbine can either be set with the bottom of the globe case submerged a few inches below the surface of the standing tail water, or it can be placed some distance above the tail water, if fitted with a draft tube. Draft tubes, however, should not exceed 15 feet in length.

Cast Iron Globe cases are made for Turbines from six to twenty-four inches in diameter inclusive.

They are constructed with brackets for supporting them on beams or piers. A draft tube may be attached if needed.

The cover of case is in two parts with a central joint.

Either or both parts can be removed for examining or removing the Turbine.

The opening is large enough to admit the parts surrounding the runner.

Hand holes are provided in the side of case as shown in the cut.

SIZES OF STYLE NO. 2 TURBINES

Style No. 2 C. M. C. Turbines are manufactured in the following sizes. These sizes are determined by the diameter of the top of the runner.

6 in.	12 in.	18 in.
8 in.	14 in.	21 in.
10 in.	16 in.	24 in.

DIMENSIONS STYLE NO. 2 IN INCHES

Size of Turbine	Diam. of Case or Distance Between Supports	Face of Inlet Flange from Center	Distance from Support to Bottom of Case	Length of Shaft from Bottom of Support	Standard Bore of Coupling	Space between Centers of Wheel and Gate Shaft
6	21	11½	7	22	1¼	7½
8	24	13	8	25	1⅜	9½
10	28	14½	9	28	1½	5
12	33	16½	10	31	1⅝	6
14	35	18	11½	35	1⅞	7
16	39	19½	13	38	2⅛	8
18	45	25	15½	41	2⅜	9
21	51	25½	16	47	2⅝	10½
24	57	27½	19	52	2⅞	12

Note.—For dimensions of inlet flanges see table on page 23.

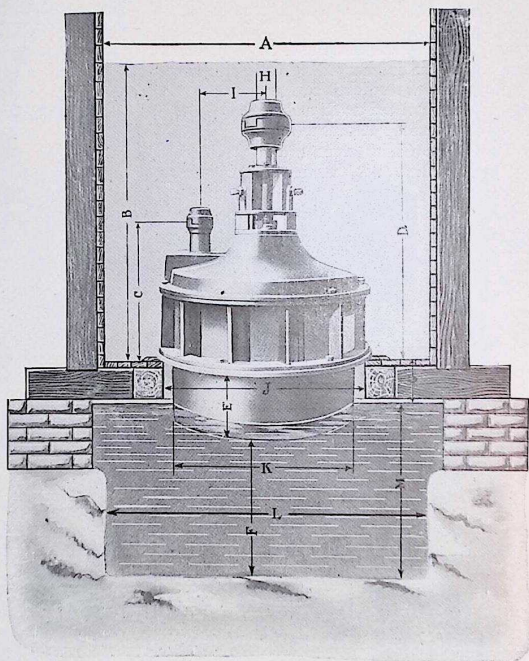


FIG. 6

C. M. C. STYLE NO. 1

Vertical Turbine in wooden Penstock. For dimensions see opposite page.

MEASUREMENTS OF WHEELS AND PENSTOCKS

All Dimensions are in inches

Size of Turbine	10	12	14	16	18	21	24	28	30	34	38	42	46	50	57 1/2	65 1/2	73 1/2	81
Size of Penstocks Inside	A	33	36	39	45	48	54	60	66	72	78	84	90	96	108	120	132	144
Water Depth Not Less Than (inches)	B	29	31	36	39	42	44	46	50	53	56	60	63	67	75	82	92	
Length of Gate Shaft from Floor	C	12	13 1/4	14 1/4	15 3/4	16 1/2	18 1/2	20	22	24 1/2	26	28	31 1/2	33 1/2	38	42	48	
Length of Wheel Shaft from Floor	D	17 1/4	19 3/4	22	24 3/4	27 3/4	31	34 1/4	38 1/4	42 1/2	46	49	56 1/2	63	70 1/4	77 1/2		
Length of Cylinders on Draft Tube	E	5	5 1/2	6 1/4	7 3/8	8 3/8	9 3/8	10 3/8	11 3/8	12 3/8	13 3/8	14 3/8	15 3/8	16 3/8	18 1/2	20	22	
Depth of Wheel Pit under Cylinders	F	15	16 1/2	18 1/4	20	21 3/8	23 3/8	24 5/8	26 5/8	28 1/2	30 1/2	32 1/2	34 1/2	36 1/2	40	44	48	
	G	2	2 1/2	2 3/4	3	3 1/2	4	4 1/2	5	5 1/2	6	7	8	10	12	14	16	
Standard Bore of Wheel Shaft Coupling	H	1 1/2	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	3 7/8	4 1/8	4 3/8	4 7/8	5 3/8	5 7/8	
Space between Center of Wheel Shaft and Gate Shafts	I	5	6	7	8	9	10 1/2	12	13 1/2	15	16 1/2	18	21	24	27	30		
Recommended Opening in Penstock	J	14	16 1/4	18 1/2	20 3/8	23 1/8	26 1/2	30	33 3/8	36 3/4	40	43 1/2	50 1/2	57 3/4	64 1/4	71		
Diameter of Cylinder on Wheel Case	K	13	15 1/4	17 1/2	19 3/8	22 1/8	25 1/2	29	32 3/8	35 3/4	39	42 1/2	49 1/2	56 3/8	63 1/4	70		
Width of Pit	L	42	45	54	57	63	72	78	84	90	96	108	120	132	144			
Depth of Tailwater in Pit	M	18	20	22	24	26	28	30	32	34	36	38	42	46	50	54		
Diameter of Wheel Case, Outside		16	18	21	23 1/2	26	28	30	34	38	42	46	50	57 1/2	65 1/2	73 1/2	81	
Bore of Gate Shaft Coupling		1	1 1/8	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/8	2 1/4	2 1/2	2 3/4	2 7/8	3	3 1/8	3 1/4	3 1/2	

Head equals B plus G.

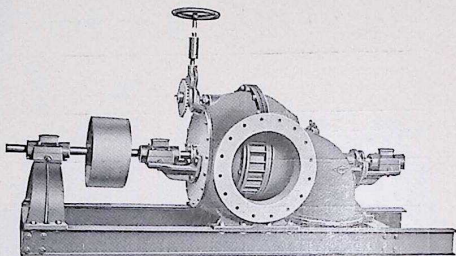
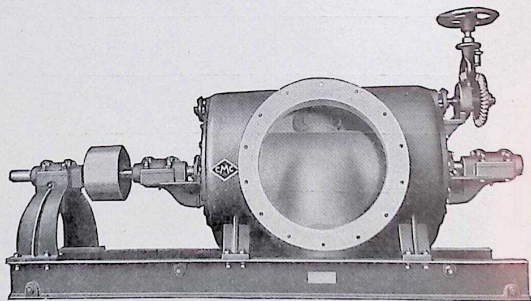


FIG. 7

STYLE NO. 4 C. M. C. HORIZONTAL TURBINE

For full description see page 27. We are prepared to furnish the necessary steel flume and flanges, see page 52 for illustrations of the various types of connections.



C. M. C. TWIN RUNNER HORIZONTAL TURBINE

This type of Turbine is ideal for use under high heads because the right and left hand runners with which this turbine is fitted equalize each other thereby eliminating all end thrust. These Turbines will develop practically twice as much horsepower as the single runner turbines of the same runner diameter. Prices upon application.

STYLE NO. 4 C. M. C. HORIZONTAL TURBINE

Horizontal Turbines are particularly adapted for direct connection with Electrical Generators. This type of turbine eliminates the necessity of driving through a pair of Bevel Gears or by means of a twisted belt, due to the horizontal position of the drive shaft, which is parallel to the average line shaft or driven shaft of a generator or machine.

All C. M. C. Horizontal Turbines are built to order so the arrangement of the pulley, the discharge and the direction of rotation of the runner can be made to meet the particular requirements of each installation.

Whenever possible the installation should be arranged so that the pull of the drive belt shall be from the under side of the pulley.

A pulley of sufficient capacity to transmit the full power of the Turbine is furnished according to sizes specified.

If The Turbine is coupled direct to a machine or to an electrical generator it is recommended that the Grundy Patented Flexible Insulated Coupling be purchased. For description, see page fifty.

The illustration on page 26 is that of a standard, horizontal turbine equipped with ring oiling bearings. All Turbines that are intended for use under a high head are fitted with Ball Bearing Thrust Bearings to take care of the end thrust.

Unless otherwise specified, the horizontal turbine will be furnished with a horizontal inlet (vertical flange, discharge to the right, pulley to the left and with the top of the runner turning from the inlet).

For your convenience, we furnish a questionnaire, and if completely filled out it will enable our engineers to make the proper recommendations for your particular requirements.

DIMENSIONS IN INCHES OF INLETS AND OUTLETS AND THEIR FLANGES

APPLICABLE TO STYLES 2 AND 4

Size of Turbine	INLETS				OUTLETS			
	Inside Diameter	Outside Diam. of Flanges	Thickness of Flanges	Bolt Circle	Number and Size of Bolts	Inside Diameter	Outside Diam. of Flanges	Thickness of Flanges
6	9	14	$\frac{3}{4}$	$12\frac{1}{2}$	12- $\frac{1}{2}$	$7\frac{1}{2}$	$11\frac{1}{2}$	$\frac{5}{8}$
8	$10\frac{1}{2}$	16	$\frac{3}{4}$	$14\frac{1}{2}$	12- $\frac{1}{2}$	$9\frac{1}{2}$	14	$\frac{5}{8}$
10	14	20	$\frac{3}{4}$	$17\frac{1}{2}$	12- $\frac{1}{2}$	$11\frac{1}{2}$	17	$\frac{5}{8}$
12	16	22	$\frac{3}{4}$	$19\frac{1}{2}$	12- $\frac{1}{2}$	14	$19\frac{1}{2}$	$\frac{3}{4}$
14	$18\frac{1}{2}$	24	$\frac{7}{8}$	$21\frac{1}{2}$	12- $\frac{1}{2}$	16	22	$\frac{3}{4}$
16	21	$27\frac{1}{2}$	$\frac{7}{8}$	$25\frac{1}{2}$	16- $\frac{5}{8}$	18	24	$\frac{7}{8}$
18	24	31	1	$28\frac{1}{2}$	16- $\frac{3}{4}$	21	27	$\frac{7}{8}$
21	28	35	1	$32\frac{1}{2}$	20- $\frac{3}{4}$	24	30	1
24	32	39	$1\frac{1}{8}$	$36\frac{1}{2}$	20- $\frac{3}{4}$	27	34	1
27	36	$43\frac{1}{2}$	$1\frac{1}{8}$	41	24- $\frac{3}{4}$	30	37	1
30	40	48	$1\frac{1}{4}$	$45\frac{1}{2}$	28- $\frac{3}{4}$	33	40	$1\frac{1}{8}$
33	44	52	$1\frac{1}{4}$	$49\frac{1}{2}$	28- $\frac{7}{8}$	36	$43\frac{1}{2}$	$1\frac{1}{8}$
36	48	57	$1\frac{1}{4}$	54	32- $\frac{7}{8}$	40	48	$1\frac{1}{8}$

Note: Bolt holes in all inlet flanges are off centers, that is, both vertical and horizontal center lines pass midway between holes. We are prepared to furnish supply pipes and Draft Tubes.

SPECIAL NOTICE

In ordering Turbines, or writing for information concerning them, or gearing of any kind in connection therewith, please give us all the data you can, in order that we may determine what will best suit your conditions. Give the head of water available or the vertical distance from surface of water in tail race to surface of water in forebay. State as nearly as possible the size stream. It is best to measure the water by a weir, (see page 9), and give the exact number of cubic feet it flows per minute. State whether you have a pond for storing water, and as nearly as you can the area of it. For connecting from the vertical shaft on the Turbines to a horizontal shaft, by gearing, state how fast the latter is to run, and the distance from the surface of tail-water or bottom of flume where Turbine sets, to the center of shaft.

It is generally a good plan to furnish a sketch to convey the idea of what you require. This may be simply pencil lines with figures for measurements. We furnish questionnaire sheets that can be filled out and mailed to us. The information requested is all essential and will enable us to recommend the style and size of Turbine best suited for your particular requirements.

In ordering Vertical Turbines be
careful always to state
which way your wheel
must run, with or
against the
Sun.



Apply this rule, also, to Single Horizontal Wheels.

**DIAMETER OF TURBINE IN INCHES, HORSE-POWER, CUBIC
FEET OF WATER USED AND REVOLUTIONS PER
MINUTE UNDER THE GIVEN HEADS**

TUR- BINE SIZE	Heads in Feet	4	6	8	10	12	14	16	18
6	Horse-Power	.22	.42	.64	.91	1.2	1.5	1.8	2.1
	Cubic Feet	36	46	53	60	65	70	74	79
	Revolutions	390	490	565	630	695	750	780	840
8	Horse-Power	.40	.74	1.1	1.6	2.1	2.6	3.2	3.8
	Cubic Feet	67	82	95	107	117	126	134	142
	Revolutions	300	370	424	475	520	562	600	638
10	Horse-Power	.64	1.2	1.8	2.5	3.3	4.2	5.1	6.1
	Cubic Feet	106	130	150	168	185	200	212	224
	Revolutions	240	300	342	383	420	452	480	516
12	Horse-Power	.93	1.7	2.6	3.7	4.8	6.0	7.4	8.8
	Cubic Feet	153	188	218	244	266	286	306	324
	Revolutions	200	249	285	320	350	380	400	430
14	Horse-Power	1.3	2.3	3.6	5.0	6.6	8.4	10.2	12.2
	Cubic Feet	210	257	296	333	366	396	420	447
	Revolutions	172	215	245	274	300	323	345	370
16	Horse-Power	1.7	3.0	4.7	6.6	8.7	10.9	13.4	16.9
	Cubic Feet	277	338	390	437	478	517	554	585
	Revolutions	150	185	215	240	260	280	300	320
18	Horse-Power	2.1	3.9	6.0	8.4	11.0	13.9	17.0	20.3
	Cubic Feet	350	430	498	556	608	657	700	744
	Revolutions	135	166	191	213	233	252	270	288
21	Horse-Power	2.9	5.4	8.2	11.5	15.2	19.1	23.2	27.8
	Cubic Feet	480	590	680	761	835	902	960	1022
	Revolutions	117	144	164	184	202	218	234	250
24	Horse-Power	3.8	7.0	10.8	15.1	19.9	25.0	30.5	36.5
	Cubic Feet	630	775	894	1000	1094	1180	1260	1338
	Revolutions	102	125	144	161	177	190	204	217
27	Horse-Power	4.8	8.9	13.7	19.1	25.2	31.8	38.8	46.3
	Cubic Feet	800	980	1130	1265	1385	1500	1600	1700
	Revolutions	92	113	130	145	159	172	184	195
30	Horse-Power	6.0	11.0	17.0	23.8	31.3	39.4	48.2	57.5
	Cubic Feet	994	1218	1407	1572	1722	1860	1988	2109
	Revolutions	83	102	117	131	144	156	166	176
33	Horse-Power	7.3	13.4	20.7	28.9	37.9	47.8	58.4	69.8
	Cubic Feet	1205	1477	1706	1907	2088	2255	2410	2558
	Revolutions	75	93	107	119	131	141	150	158
36	Horse-Power	8.7	16.0	24.6	34.4	45.2	57.0	69.6	83.0
	Cubic Feet	1437	1760	2034	2273	2488	2687	2874	3045
	Revolutions	69	85	98	109	120	130	138	146
42	Horse-Power	11.9	21.9	33.7	47.1	62.0	78.0	95.2	113
	Cubic Feet	1965	2407	2783	3112	3409	3675	3930	4171
	Revolutions	60	73	84	94	104	112	120	127
48	Horse-Power	15.5	28.6	44.1	61.6	81.0	102	124	148
	Cubic Feet	2570	3150	3637	4068	4458	4806	5140	5452
	Revolutions	52	64	74	83	91	98	104	110
54	Horse-Power	19.7	36.2	55.7	77.8	102	129	157	187
	Cubic Feet	3250	3980	4600	5140	5630	6100	6500	6880
	Revolutions	47	57	66	74	82	88	94	100
60	Horse-Power	24.5	45.0	69.4	97.0	127	160	195	233
	Cubic Feet	4040	4955	5725	6400	7010	7575	8075	8560
	Revolutions	43	52	60	68	74	80	85	90

**DIAMETER OF TURBINE IN INCHES, HORSE-POWER, CUBIC
FEET OF WATER USED AND REVOLUTIONS PER
MINUTE UNDER THE GIVEN HEADS**

TUR- BINE SIZE	Heads in Feet	20	22	24	26	28	30	32	34
6	Horse-Power	2.5	2.9	3.3	3.8	4.2	4.7	5.1	5.6
	Cubic Feet	84	88	92	96	100	103	106	110
	Revolutions	890	940	980	1020	1060	1100	1135	1170
8	Horse-Power	4.5	5.2	6.0	6.7	7.5	8.3	9.2	10.1
	Cubic Feet	150	157	164	171	178	184	190	196
	Revolutions	676	710	740	772	800	825	848	876
10	Horse-Power	7.1	8.2	9.4	10.6	11.9	13.2	14.5	16.0
	Cubic Feet	236	243	260	270	280	290	300	309
	Revolutions	546	574	600	624	646	668	684	708
12	Horse-Power	10.3	11.9	13.6	15.4	17.2	19.1	21.1	23.2
	Cubic Feet	342	359	376	391	406	421	436	450
	Revolutions	452	476	498	518	538	556	570	590
14	Horse-Power	14.3	16.5	18.7	21.1	23.6	26.1	28.7	31.5
	Cubic Feet	472	495	514	536	556	575	592	612
	Revolutions	390	410	430	448	464	478	490	508
16	Horse-Power	18.6	21.5	24.6	27.8	31.1	34.4	37.8	41.4
	Cubic Feet	616	646	676	706	734	758	780	805
	Revolutions	338	354	370	386	402	416	430	446
18	Horse-Power	23.8	27.4	31.2	35.2	39.5	43.8	48.3	52.8
	Cubic Feet	785	823	860	895	930	964	996	1026
	Revolutions	304	318	332	346	358	370	382	394
21	Horse-Power	32.6	37.6	42.9	48.3	54.0	60.0	66.0	72.2
	Cubic Feet	1073	1130	1180	1227	1273	1318	1360	1402
	Revolutions	263	276	288	300	310	319	328	336
24	Horse-Power	42.7	49.3	56.3	63.4	70.9	78.6	86.7	94.9
	Cubic Feet	1410	1480	1550	1610	1671	1730	1788	1842
	Revolutions	229	240	250	260	270	279	288	296
27	Horse-Power	54.2	62.6	71.2	80.5	90.0	99.5	109	120
	Cubic Feet	1790	1878	1960	2045	2120	2190	2260	2330
	Revolutions	205	215	225	235	244	252	260	268
30	Horse-Power	67.3	77.7	88.6	99.8	111	123	136	149
	Cubic Feet	2222	2332	2436	2535	2630	2723	2814	2898
	Revolutions	186	194	204	212	220	227	234	242
33	Horse-Power	81.7	94.2	107	121	135	150	165	181
	Cubic Feet	2696	2828	2954	3075	3190	3302	3412	3515
	Revolutions	169	177	185	192	200	207	214	220
36	Horse-Power	97.3	112	128	144	161	178	197	216
	Cubic Feet	3212	3370	3520	3666	3800	3938	4068	4190
	Revolutions	155	162	170	178	184	190	198	202
42	Horse-Power	133	153	173	197	219	243	270	295
	Cubic Feet	4395	4607	4815	5014	5200	5388	5568	5734
	Revolutions	134	140	146	152	158	164	168	174
48	Horse-Power	174	201	229	258	288	320	352	386
	Cubic Feet	5740	6028	6300	6556	6804	7043	7274	7500
	Revolutions	118	124	128	134	138	144	148	154
54	Horse-Power	219	253	289	326	365	404	446	488
	Cubic Feet	7240	7600	7960	8280	8600	8900	9200	9480
	Revolutions	105	110	114	119	124	128	132	136
60	Horse-Power	273	316	360	406	454	504	555	608
	Cubic Feet	9030	9480	9910	10325	10720	11095	11450	11800
	Revolutions	95	100	104	108	112	116	120	124

**DIAMETER OF TURBINES IN INCHES, HORSE-POWER, CUBIC
FEET OF WATER USED AND REVOLUTIONS PER
MINUTE UNDER THE GIVEN HEADS**

TUR- BINE SIZE	Heads in Feet	36	38	40	42	44	46	48	50
6	Horse-Power	6.2	6.7	7.2	7.8	8.4	8.9	9.4	10.1
	Cubic Feet	114	117	120	123	126	128	130	133
	Revolutions	1200	1230	1260	1300	1330	1360	1390	1420
8	Horse-Power	11.0	12.0	13.0	13.9	14.9	16.0	17.0	18.1
	Cubic Feet	202	208	214	219	224	229	234	239
	Revolutions	902	928	950	978	1000	1020	1040	1060
10	Horse-Power	17.3	18.8	20.3	22.0	23.6	25.2	26.9	28.6
	Cubic Feet	318	327	336	345	354	362	370	378
	Revolutions	728	747	766	786	805	823	840	856
12	Horse-Power	25.3	27.4	29.5	31.7	34.0	36.3	38.7	41.1
	Cubic Feet	464	476	488	499	510	521	532	543
	Revolutions	607	624	640	656	671	686	700	713
14	Horse-Power	34.3	37.3	40.0	43.4	46.5	49.8	53.2	56.6
	Cubic Feet	630	649	666	682	698	715	732	747
	Revolutions	522	535	548	561	574	587	600	612
16	Horse-Power	45.2	49.0	53.0	57.0	61.2	65.1	69.5	73.8
	Cubic Feet	829	852	874	896	918	935	956	975
	Revolutions	458	469	480	490	500	510	520	530
18	Horse-Power	57.6	62.4	67.4	72.4	77.6	83.1	88.4	94.1
	Cubic Feet	1056	1085	1112	1138	1165	1192	1216	1242
	Revolutions	406	416	426	436	446	456	466	475
21	Horse-Power	78.6	85.3	92.2	99.2	106	114	121	129
	Cubic Feet	1442	1482	1522	1560	1598	1634	1670	1705
	Revolutions	347	358	368	378	387	396	404	410
24	Horse-Power	103	112	121	130	140	149	159	169
	Cubic Feet	1895	1948	2000	2050	2098	2144	2188	2230
	Revolutions	305	314	322	330	338	346	354	360
27	Horse-Power	131	142	153	165	177	189	201	214
	Cubic Feet	2398	2464	2530	2592	2654	2712	2770	2825
	Revolutions	276	283	290	297	304	311	318	324
30	Horse-Power	162	176	190	205	220	235	250	266
	Cubic Feet	2980	3062	3144	3224	3300	3374	3444	3510
	Revolutions	250	256	262	269	276	282	288	292
33	Horse-Power	197	214	231	248	266	285	303	322
	Cubic Feet	3615	3715	3814	3906	3998	4087	4176	4260
	Revolutions	226	232	238	244	250	256	262	267
36	Horse-Power	235	255	275	296	317	339	362	384
	Cubic Feet	4310	4428	4540	4656	4766	4871	4976	5075
	Revolutions	208	213	218	224	230	235	240	245
42	Horse-Power	322	349	377	405	435	465	496	527
	Cubic Feet	5900	6064	6224	6375	6526	6672	6818	6955
	Revolutions	180	184	188	193	198	203	208	212
48	Horse-Power	421	456	493	530	568	608	648	689
	Cubic Feet	7719	7931	8136	8336	8531	8726	8916	9096
	Revolutions	158	162	166	170	174	178	182	186
54	Horse-Power	532	577	623	670	718	768	819	870
	Cubic Feet	9755	10020	10280	10530	10780	11020	11260	11480
	Revolutions	140	144	148	152	156	160	164	168
60	Horse-Power	662	718	775	835	895	957	1019	1082
	Cubic Feet	12140	12470	12800	13120	13430	13730	14020	14285
	Revolutions	128	132	136	140	143	146	148	150

**DIAMETER OF TURBINES IN INCHES, HORSE-POWER, CUBIC
FEET OF WATER USED AND REVOLUTIONS PER
MINUTE UNDER THE GIVEN HEADS**

TUR- BINE SIZE	Heads in Feet	52	54	56	58	60	62	64	66
6	Horse-Power	10.8	11.4	12.0	12.6	13.2	13.9	14.5	15.2
	Cubic Feet	138	140	142	144	146	148	150	152
	Revolutions	1450	1475	1500	1520	1540	1560	1580	1600
8	Horse-Power	19.2	20.3	21.4	22.5	23.6	24.8	26.0	27.1
	Cubic Feet	244	248	252	256	260	264	268	271
	Revolutions	1080	1100	1120	1140	1160	1180	1200	1218
10	Horse-Power	30.4	32.1	33.9	35.6	37.4	39.2	41.1	43.0
	Cubic Feet	386	393	400	406	412	418	424	430
	Revolutions	872	888	904	920	935	950	965	980
12	Horse-Power	43.5	46.0	48.5	51.1	53.8	56.5	59.3	62.2
	Cubic Feet	553	563	572	582	592	602	612	622
	Revolutions	726	740	754	767	780	793	806	818
14	Horse-Power	60.0	63.5	67.2	70.6	74.2	77.8	81.4	85.3
	Cubic Feet	762	777	792	804	816	828	840	853
	Revolutions	625	637	648	659	670	681	692	703
16	Horse-Power	78.4	83.0	87.7	92.5	97.4	102	107	112
	Cubic Feet	995	1015	1034	1053	1072	1090	1108	1124
	Revolutions	542	552	563	574	585	595	605	614
18	Horse-Power	99.7	105	111	117	123	129	135	142
	Cubic Feet	1266	1290	1314	1336	1358	1379	1400	1422
	Revolutions	487	497	507	517	525	533	542	550
21	Horse-Power	137	145	153	161	169	177	186	195
	Cubic Feet	1738	1771	1804	1834	1864	1892	1920	1950
	Revolutions	420	428	436	444	452	460	468	476
24	Horse-Power	179	189	200	211	222	233	244	256
	Cubic Feet	2274	2318	2360	2400	2440	2480	2520	2558
	Revolutions	368	375	382	389	396	403	410	416
	Heads in Feet	68	70	75	80	85	90	95	100
6	Horse-Power	15.8	16.5	18.4	20.3	22.3	25.8	26.3	28.5
	Cubic Feet	154	156	162	168	173	178	183	188
	Revolutions	1620	1640	1690	1740	1790	1840	1890	1940
8	Horse-Power	28.2	29.3	32.7	36.3	39.6	43.1	46.6	50.0
	Cubic Feet	274	277	288	300	308	316	324	330
	Revolutions	1236	1254	1295	1335	1375	1410	1445	1480
10	Horse-Power	44.9	46.8	51.9	57.2	62.4	67.9	73.4	79.1
	Cubic Feet	436	442	457	472	485	498	510	522
	Revolutions	995	1010	1048	1085	1120	1155	1190	1220
12	Horse-Power	65.1	68.1	75.4	82.9	90.6	98.7	107	115
	Cubic Feet	632	642	664	684	704	724	744	764
	Revolutions	830	842	870	896	922	948	974	1000
14	Horse-Power	89.2	93.2	103	114	125	136	147	158
	Cubic Feet	866	879	912	944	970	996	1022	1046
	Revolutions	714	725	750	775	800	824	848	870
16	Horse-Power	117	122	135	149	163	178	193	209
	Cubic Feet	1140	1155	1194	1232	1270	1307	1344	1380
	Revolutions	623	632	654	676	698	720	740	760
18	Horse-Power	148	155	172	190	208	227	246	266
	Cubic Feet	1443	1464	1517	1570	1617	1664	1710	1755
	Revolutions	558	566	586	606	626	645	663	680
21	Horse-Power	204	213	236	261	286	311	338	365
	Cubic Feet	1980	2010	2083	2156	2220	2284	2347	2410
	Revolutions	483	490	508	525	543	559	574	588
24	Horse-Power	267	279	310	342	374	408	443	478
	Cubic Feet	2596	2634	2727	2820	2908	2995	3080	3160
	Revolutions	422	428	443	458	472	486	499	512

C. M. C. SPUR GEARS



FIG. 201

We manufactured practically every style and size of gears, all of which are listed in a special Gear Catalogue that will be mailed upon request. C. M. C. Mortise Gears, Pinions and Cogs are listed in the following pages, and on page 34 is printed a gear chart showing the application and giving the names of the various types of gears.

C. M. C.
SPUR MORTISE GEARS AND
PINIONS

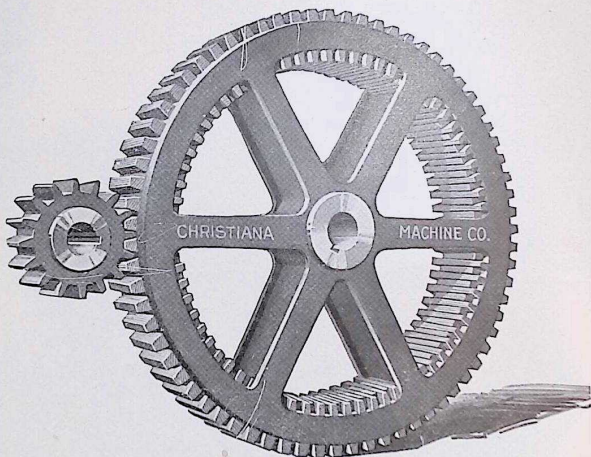


FIG. 202

We have specialized in the manufacture of Mortise Gears, Pinions and Cogs for more than fifty years. All three types, that is, Spur, Mitre and Bevel Mortise Gears are particularly adaptable for use in connection with Hydraulic Turbines.

The Gears are filled with cogs cut from especially selected Michigan hard rock maple water cured and kiln dried and the teeth of the pinions are machine cut thereby assuring quietness and smoothness in running. Separate list of cogs and keys on page 47.

SPUR MORTISE GEARS **BORED WITH KEYSEAT OR SET SCREWS**

1¼ INCH PITCH

No.	Pitch Diam. Ins.	No of teeth	Face Ins.	H. P. *	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. *	List Price
2	23.88	60	1¾		140.00						

1⅜ INCH PITCH

8	28.01	64	1¾		153.00						
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1½ INCH PITCH

11	13.37	28	3		102.00	14	29.60	62	3½		164.00
12	23.88	50	3½		122.50						

1¾ INCH PITCH

17	22.28	40	4		133.00	21	39.00	70	4		197.00
20	34.54	62	4		180.00						

2 INCH PITCH

26	15.27	24	6		102.00	35	38.20	60	6		201.00
27	17.19	27	6		110.00	36	44.56	70	6		228.00
28	20.38	32	6		124.00	37	45.84	72	6		234.00
44	21.01	33	6		127.00	38	50.30	79	6		253.00
29	22.91	36	6		135.00	39	53.47	84	6		267.00
30	25.47	40	6		146.00	41	57.30	90	6		283.00
31	28.01	44	6		157.00	40	63.03	99	6		308.00
33	30.55	48	6		168.00	42	71.30	112	6		344.00
32	33.10	52	6		179.00	43	80.21	126	6		382.00
34	35.65	56	6		190.00						

2¼ INCH PITCH

53	37.24	52	6		211.00	60	85.95	120	6		434.00
54	42.97	60	6		238.00	59	90.24	126	6		464.00
56	64.46	90	6		341.00						

2½ INCH PITCH

61	16.71	21	6		117.00	146	39.00	49	10		289.00
62	19.90	25	6		134.00	65	42.97	54	7		272.00
63	24.66	31	6		160.00	64	57.30	72	5½		325.00
70	27.05	34	6		172.00	68	66.84	84	6½		396.00
69	27.85	35	7		187.00	67	71.62	90	8		457.00
66	38.19	48	8		258.00						

2¾ INCH PITCH

151	19.26	22	6		110.00						
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* H. P.'s are the same as H. P.'s of Pinions with which they are used.
 See pages 48-49 for extras for over-size bores, key-seating set-screws, etc.

SPUR MORTISE PINIONS BORED WITH KEYSEAT OR SET SCREWS

1¼ INCH PITCH

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	List Price
1	7.16	18	3	3.8	\$34.00	4	23.87	60	1¾	6.0	\$84.00

1⅜ INCH PITCH

8	28.01	64	1¾	7.0	96.00						
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1½ INCH PITCH

11	5.25	11	3½	4.0	27.00	13	9.55	20	4	7.0	42.00
14	6.68	14	3	4.0	31.00	12	16.71	35	6	18.0	73.00

1¾ INCH PITCH

17	11.14	20	4	9.6	52.00	21	17.83	32	6	22.0	85.00
18	12.81	23	4	11.0	58.00	22	19.50	35	4	16.0	83.00
20	15.60	28	4	13.0	68.00						

2 INCH PITCH

49	6.37	10	6	10.0	41.00	33	22.92	36	6	32.5	108.00
48	7.64	12	6	12.0	46.00	34	23.56	37	6	33.0	110.00
47	9.54	15	6	15.0	54.00	35	25.47	40	6	34.5	118.00
41	10.18	16	6	15.5	56.00	44	26.10	41	6	35.0	121.00
26	10.82	17	6	16.0	59.00	42	26.74	42	6	35.5	123.00
45	11.46	18	6	17.0	61.00	36	28.01	44	6	36.0	128.00
27	12.73	20	6	19.0	66.00	37	29.29	46	6	37.0	134.00
28	15.27	24	6	22.0	77.00	38	31.83	50	6	39.0	144.00
29	17.19	27	6	25.0	85.00	39	33.74	53	6	40.0	152.00
30	19.10	30	6	27.0	92.00	40	36.93	58	6	42.0	164.00
31	21.01	33	6	30.0	100.00	46	39.48	62	6	44.0	175.00
32	22.27	35	6	32.0	105.00	43	44.57	70	6	47.0	195.00

2¼ INCH PITCH

56	12.17	17	6	20.0	66.00	54	19.34	27	6	31.0	97.00
57	14.32	20	6½	25.0	78.00	63	21.48	30	6	33.0	106.00
55	15.76	22	7¾	32.0	89.00	61	22.20	31	6	34.0	110.00
58	17.19	24	6½	30.0	90.00	62	22.92	32	6	35.0	113.00
59	17.19	24	7	32.0	93.00	65	28.65	40	7	45.0	144.00
60	18.62	26	6	30.0	94.00						

2½ INCH PITCH

146	8.76	11	5	14.0	53.00	68	18.30	23	6½	37.0	102.00
148	9.55	12	10	30.0	73.00	69	19.89	25	6½	40.0	109.00
75	11.14	14	7	21.0	71.00	70	21.48	27	7	45.0	120.00
91	11.93	15	7	26.0	75.00	149	23.07	29	7	48.0	127.00
66	14.32	18	6	26.0	81.00	72	25.46	32	6	43.0	131.00
71	15.92	20	7	33.0	94.00	73	35.01	44	7	56.0	183.00
67	16.71	21	6½	32.0	95.00	74	42.97	54	8	75.0	243.00
150	17.50	22	7	36.0	101.00						

See pages 48-49 for over-size bores, keyseating, set-screws, etc.

C. M. C. CAST IRON WORM AND WORM GEAR

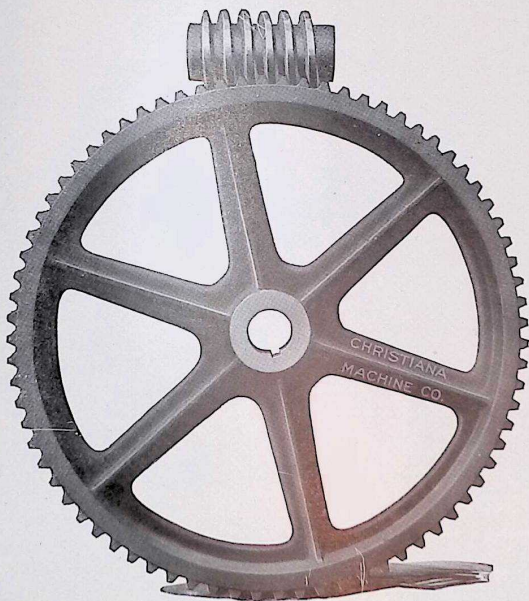


FIG. 203

We are prepared to furnish on specification cast worms and worm gears.

Worms are made by a special process which gives them a true travel.

Prices on application.

C. M. C.
MITER MORTISE GEARS
AND PINIONS

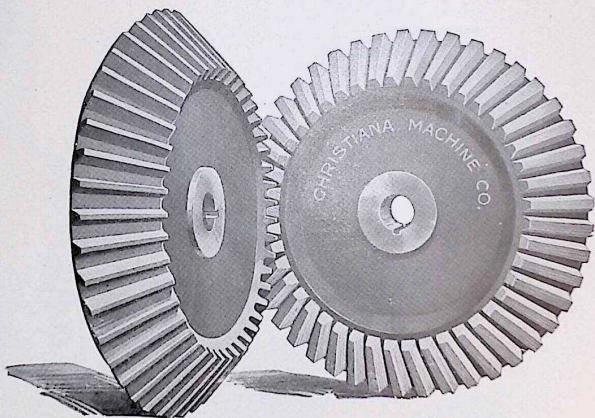


FIG. 204

Where no difference in speed is required, C. M. C. Miter Mortise Gears will form an excellent means of transmission from the Turbine shaft to the line shaft or machine.

These Gears will operate only in pairs as listed on the following page.

The Cogs with which the Gear is filled are cut from especially selected Michigan hard rock maple water cured and kiln dried, and the teeth of the Pinion are accurately machined. Separate list of Cogs and Keys on page 47.

MITER MORTISE GEARS AND PINIONS

BORED WITH KEYSEAT OR SET SCREWS

1¼ INCH PITCH

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	List Price
24	15.91 15.91	40 40	3¼	5.6	\$64.00 119.00						

1½ INCH PITCH

3	13.85 13.85	29 29	4½	9.0	58.00 108.00	1	15.28 15.28	32	3½	7.0	\$60.00 110.00
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1⅝ INCH PITCH

2	16.55 16.55	32 32	4	10.0	67.00 113.00						
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1¾ INCH PITCH

4	24.51 24.51	44 44	4½	15.0	105.00 143.00						
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2 INCH PITCH

5	20.37 20.37	32 32	4½	15.0	90.00 120.00	66	22.91 22.91	36 36	6	23.0	108.00 135.00
67	21.64 21.64	34 34	4½	16.0	95.00 120.00	6	30.56 30.56	48 48	6	30.0	139.00 168.00

2¼ INCH PITCH

7	27.22 27.22	38 38	7	32.0	138.00 172.00						
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2½ INCH PITCH

9	38.20 38.20	48 48	8	52.0	209.00 258.00						
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3 INCH PITCH

11	28.65 28.65	30 30	8	50.0	178.00 223.00	12	34.38 34.38	36 36	8	70.0	209.00 262.00
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The second wheel of each pair is the mortise wheel.

C. M. C.
BEVEL MORTISE GEARS
AND PINIONS

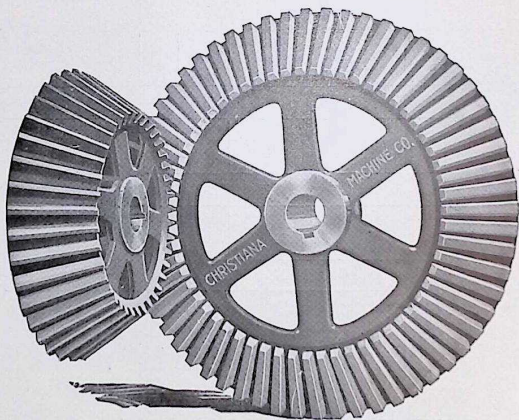


FIG. 205

C. M. C. Bevel Mortise Gears and Pinions are used extensively in connection with Hydraulic Turbines. Our big assortment of patterns makes it possible to select a pair of Gears of the exact ratio and horse power that you require.

Particular care is taken in the filling of the Gear. The Cogs are cut from especially selected Michigan hard rock maple water cured and kiln dried and the teeth of the metal pinion are machine cut thereby assuring smoothness and quietness in operation. Separate list of Cogs and Keys on page 47.

BEVEL MORTISE GEARS AND PINIONS

BORED WITH KEYSEAT OR SET SCREWS

1½ INCH PITCH

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price
2	7.16 19.10	15 40	4	3.5	2.67	\$34.00 126.00	3	9.55 19.10	20 40	3½	4.5	2.00	\$43.00 128.00
60	7.64 30.08	16 63	5	5.5	3.94	38.00 172.00	59	14.33 16.24	30 34	4	7.0	1.13	58.00 115.00
1	7.64 30.56	16 64	4½	5.0	4.00	36.00 172.00							

1⅝ INCH PITCH

6	6.20 37.24	12 72	4	4.5	6.00	32.00 189.00	4	11.90 37.24	23 72	5	9.0	3.13	53.00 193.00
63	6.20 37.24	12 72	5	5.6	6.00	33.00 193.00	5	15.52 18.61	30 36	4	8.0	1.20	63.00 121.00
62	10.34 22.76	20 44	4	6.0	2.20	46.00 136.00							

1¾ INCH PITCH

67	6.68 40.11	12 72	5	6.5	6.00	37.00 207.00	68	11.70 32.31	21 58	5	9.5	2.76	57.00 176.00
70S	8.35 39.00	15 70	5	8.0	4.66	44.00 202.00							
70	7.80 39.00	14 70	5	7.5	5.00	41.00 202.00	64	11.70 36.76	21 66	4½	9.0	3.14	55.00 191.00
95	9.47 44.01	17 79	5	8.4	4.65	48.00 222.00	73	12.25 16.70	22 30	5	8.0	1.36	59.00 114.00
13	10.03 40.11	18 72	5	8.5	4.00	50.00 207.00	7	12.25 24.51	22 44	4½	8.3	2.00	57.00 143.00
75	11.14 44.01	20 79	5	9.6	3.95	54.00 222.00	8	12.81 24.51	23 44	5	9.5	1.91	61.00 145.00
69	11.70 20.05	21 36	4	7.0	1.71	54.00 124.00	12	13.93 30.64	25 55	5	11.0	2.20	65.00 169.00
9	11.70 27.85	21 50	3½	6.5	2.38	52.00 152.00	74	14.48 44.00	26 79	5	12.0	3.03	68.00 222.00
10	11.70 27.85	21 50	5	9.0	2.38	57.00 158.00	16	15.04 30.08	27 54	5	12.0	2.00	70.00 167.00

BEVEL MORTISE GEARS AND PINIONS

BORED WITH KEYSEAT OR SET SCREWS

1 $\frac{3}{4}$ INCH PITCH

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price
14	16.70 22.28	30 40	4	10.0	1.33	\$73.00 133.00	55	19.50 28.97	35 52	5	14.0	1.49	\$87.00 163.00
15	17.26 25.07	31 45	5	12.0	1.45	78.00 146.00	66	21.73 22.28	39 49	4 $\frac{1}{2}$	14.0	1.03	94.00 134.00
65	17.82 19.50	32 35	4 $\frac{1}{2}$	11.0	1.10	79.00 124.00	72	24.51 30.64	44 55	6	21.0	1.25	114.00 173.00
71	18.94 22.28	34 40	4 $\frac{1}{2}$	12.0	1.18	83.00 134.00	11	24.51 31.20	44 56	5	20.0	1.27	107.00 171.00

2 INCH PITCH

89	8.28 42.02	13 66	5	9.5	5.07	46.00 206.00	87	15.27 45.20	24 71	6	17.5	2.96	77.00 231.00
83	8.28 54.75	13 86	6	10.0	6.62	48.00 272.00	17	15.91 35.01	25 55	6	17.0	2.20	79.00 187.00
86	8.91 45.20	14 71	6	10.5	5.07	52.00 231.00	24	17.82 30.55	28 48	6	18.0	1.71	87.00 168.00
86 $\frac{1}{2}$	9.54 45.20	15 71	6	11.0	4.73	54.00 231.00	18	19.10 25.46	30 40	5	16.5	1.33	88.00 138.00
93	10.18 30.55	16 48	6	11.0	3.00	56.00 168.00							
53	10.18 35.65	16 56	4 $\frac{1}{2}$	9.0	3.50	52.00 176.00	81	19.73 39.47	31 62	5	18.0	2.00	90.00 196.00
82	10.18 41.38	16 65	6	12.0	4.06	56.00 215.00	27	20.37 36.28	32 57	6	22.0	1.76	97.00 193.00
52	13.37 31.83	21 50	6	13.0	2.38	69.00 173.00	79	21.64 26.73	34 42	6	21.0	1.24	103.00 151.00
92	13.37 46.47	21 73	6	15.0	3.47	69.00 235.00							
85	14.00 22.27	22 35	5	11.0	1.59	68.00 125.00	80	21.64 30.55	34 48	6	21.5	1.41	103.00 168.00
90	14.00 42.02	22 66	5	16.9	3.00	68.00 202.00	22	22.91 34.38	36 54	6	22.5	1.50	108.00 181.00
20	14.64 30.55	23 48	6	15.0	2.09	71.00 168.00	19	23.55 25.46	37 40	6	23.0	1.08	110.00 146.00
54	15.27 35.65	24 56	5	14.0	2.33	73.00 180.00	23	24.83 48.38	39 76	6	27.0	1.95	115.00 245.00
25	15.27 42.02	24 66	6	17.0	2.75	77.00 217.00							

BEVEL MORTISE GEARS AND PINIONS **BORED WITH KEYSEAT OR SET SCREWS** **2 INCH PITCH**

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price
26	29.28 48.38	46 76	6	30.0	1.59	134.00 245.00	84	32.47 35.65	51 56	5½	29.0	1.10	143.00 185.00
21	29.92 30.55	47 48	6	31.0	1.02	136.00 168.00	88 88	38.20 57.30	60 90	6	36.0	1.50	170.00 283.00

2¼ INCH PITCH

33	10.03 40.82	14 57	6	14.0	4.07	55.00 228.00							
76	10.03 46.55	14 65	7	15.0	4.64	60.00 269.00	41	24.34 42.97	34 60	7	31.0	1.76	125.00 251.00
91	10.74 47.27	15 66	7	16.0	4.4	63.00 273.00							
78	12.89 46.55	18 65	7	18.5	3.61	73.00 269.00	35	24.34 48.70	34 68	8	35.0	2.00	131.00 294.00
32	12.89 47.98	18 67	6	17.0	3.72	70.00 262.00	30	26.50 30.08	37 42	6	29.0	1.14	128.00 177.00
36S	15.76 42.98	22 60	7	22.0	2.72	86.00 251.00							
77	15.76 46.55	22 65	7	22.0	2.95	86.00 269.00	57	30.08 42.97	42 60	7	38.0	1.43	151.00 251.00
117	15.76 51.56	22 72	7	23.0	3.27	86.00 298.00							
29	17.19 38.68	24 54	7	23.0	2.25	93.00 229.00	34	30.08 60.16	42 84	7	40.0	2.00	151.00 337.00
36	17.19 42.97	24 60	7	24.0	2.50	93.00 251.00	51	32.23 38.68	45 54	6	36.0	1.20	153.00 218.00
28	19.34 84.51	27 118	6	28.0	4.37	97.00 437.00	31	35.09 35.81	49 50	8	44.0	1.02	182.00 226.00

2½ INCH PITCH

104	13.53 54.91	17 69	8	25.0	4.06	87.00 357.00	97	22.28 52.52	28 66	5	28.0	2.36	111.00 292.00
44	14.32 50.13	18 63	8	26.0	3.50	91.00 329.00	43	22.28 57.30	28 72	8	45.0	2.57	130.00 371.00
37	15.12 42.97	19 54	8	26.0	2.84	94.00 286.00	96	22.28 62.07	28 78	6	34.0	2.79	117.00 360.00
94	16.71 46.15	21 58	7	26.0	2.76	97.00 290.00	98	22.28 66.84	28 84	6	34.0	3.00	117.00 385.00
102	19.89 36.60	25 46	7	30.0	1.84	112.00 236.00	105	23.07 52.52	29 66	8	38.0	2.28	134.00 343.00

BEVEL MORTISE GEARS AND PINIONS

BORED WITH KEYSEAT OR SET SCREWS

2½ INCH PITCH

No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price	No.	Pitch Diam. Ins.	No. of teeth	Face Ins.	H. P. 100 RPM	Ratio	List Price
99	20.69 30.24	26 38	6	26.0	1.46	\$110.00 189.00	56	24.66 25.46	31 32	5	25.0	1.03	\$121.00 155.00
43S	20.69 57.30	26 72	8	43.0	2.74	121.00 371.00	108	25.46 38.19	32 48	8	40.0	1.5	148.00 255.00
38	21.48 47.74	27 60	8	35.0	2.22	126.00 315.00	101	25.46 59.68	32 75	10	50.0	2.34	161.00 424.00
103	27.05 35.01	34 44	8	41.0	1.29	154.00 240.00	39	31.83 47.74	40 60	9	54.0	1.50	187.00 330.00
							39S	33.42 47.74	42 60	9	58.0	1.43	196.00 330.00
42	27.05 37.40	34 47	8	42.0	1.38	154.00 253.00	40	35.81 71.62	45 90	8	60.0	2.00	197.00 457.00
58	27.85 33.42	35 42	7	38.0	1.20	140.00 218.00	48	42.97 71.62	54 90	9	72.0	1.67	245.00 480.00

2¾ INCH PITCH

49	34.13 57.77	39 66	8	64.0	1.69	195.00 397.00	106	45.51 47.27	52 54	10	85.0	1.04	278.00 365.00
107	35.00 52.52	40 60	9	68.0	1.50	210.00 383.00							

3 INCH PITCH

50	19.10 57.30	20 60	12	55.0	3.00	154.00 512.00	111	29.60 57.30	31 60	10	72.0	1.94	204.00 465.00
112	26.74 47.75	28 50	9	60.0	1.79	177.00 373.00	113	34.38 46.79	36 49	9	71.0	1.36	221.00 366.00
46	28.64 34.38	30 36	8	54.0	1.20	178.00 262.00	47	44.88 51.56	47 51	14	110.0	1.15	355.00 506.00

4 INCH PITCH

119	40.75 77.67	32 61	13	47.0	1.91								

Price upon application.

Second wheel of each pair is the mortise wheel.

SPLIT BEVEL MORTISE GEARS

BORED WITH KEYSEAT OR SET SCREWS

3 INCH PITCH

114	44.88 48.70	47 51	10	118.5	1.08	444.00 560.00	115	35.33 61.12	37 64	10	93.0	1.73	357.00 742.00
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C. M. C. COGS FOR MORTISE GEARS

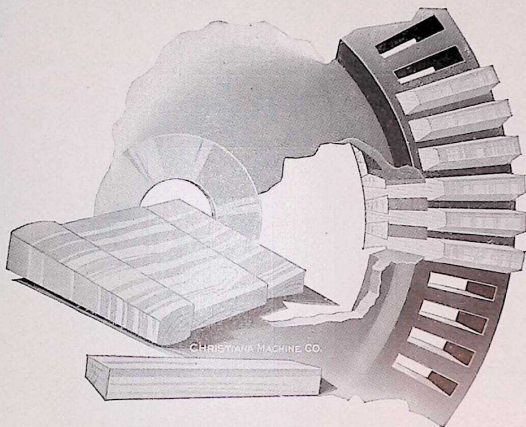


FIG. 206

LIST PRICE PER TOOTH

Face, Inches	3	4	5	6	7	8	9	10	11	12	13	14
Rough Cog, Each	\$3.35	.40	.50	.60	.70	.80	.95	1.15	1.35	1.55	1.80	2.15
Finished Cog, Ea.	.55	.65	.70	.80	.95	1.10	1.30	1.50	1.70	2.00	2.30	2.65
Keys for Teeth, Ea.	.12	.12	.14	.14	.16	.16	.18	.20	.22	.26	.30	.36

LIST PRICE FOR FILLING AND TRIMMING MORTISE GEARS

Face, Inches	3	4	5	6	7	8	9	10	11	12	13	14
Price per Tooth	1.10	1.25	1.40	1.55	1.75	2.00	2.40	2.90	3.30	4.00	4.60	5.50

LIST PRICE FOR DRESSING IRON GEARS

Face, Inches	3	4	5	6	7	8	9	10	11	12	13	14
Price per Tooth	1.25	1.35	1.80	2.00	2.25	2.55	2.85	3.40	4.00	4.60	5.20	5.75

Cut from especially selected Michigan hard Rock Maple, water-cured and kiln-dried.

EXTRAS

BORES OF CAST IRON GEARS

Maximum bores at regular list prices; for larger bores add extra percentages to regular list prices.

Pitch Diameter of Gear Inches	Pitch, Inches				Extra for Each Additional $\frac{1}{2}$ -inch or Fraction Thereof
	$\frac{3}{4}$ -1	$1\frac{1}{8}$ -1 $\frac{1}{2}$	$1\frac{3}{4}$ -2	$2\frac{1}{4}$ -4	
6.00 to 9	$1\frac{5}{16}$	$2\frac{1}{16}$	$3\frac{7}{16}$	$3\frac{5}{16}$	10 per cent.
9.01 to 15	$2\frac{7}{16}$	$3\frac{3}{16}$	$3\frac{15}{16}$	$4\frac{7}{16}$	10 per cent.
15.01 to 20	$2\frac{11}{16}$	$3\frac{7}{16}$	$4\frac{7}{16}$	$4\frac{15}{16}$	10 per cent.
20.01 to 30	$2\frac{15}{16}$	$3\frac{15}{16}$	$4\frac{11}{16}$	$5\frac{7}{16}$	10 per cent.
30.01 to 42	$3\frac{3}{16}$	$4\frac{7}{16}$	$4\frac{15}{16}$	$5\frac{15}{16}$	5 per cent.
42.01 to 48	$3\frac{7}{16}$	$4\frac{15}{16}$	$5\frac{7}{16}$	$6\frac{1}{2}$	5 per cent.
48.01 to 60	$3\frac{15}{16}$	$5\frac{7}{16}$	$5\frac{15}{16}$	7	5 per cent.
60.01 and up	$4\frac{7}{16}$	$5\frac{15}{16}$	$6\frac{1}{2}$	$7\frac{1}{2}$	5 per cent.

KEYS

For gears with keys, add the following charges to regular list prices for gears.

Shaft Diameters Inches	List Price Keys Only, Hub Length, Inches				
	6	8	10	12	14
Up to $1\frac{1}{16}$	\$0.35	\$0.35	\$0.35	\$0.50	\$0.55
$1\frac{1}{16}$ - $2\frac{3}{16}$	.50	.50	.50	.55	.65
$2\frac{7}{16}$ - $2\frac{11}{16}$	.55	.55	.55	.65	.85
$2\frac{15}{16}$ - $3\frac{3}{16}$	.65	.65	.70	.85	1.05
$3\frac{7}{16}$ - $3\frac{11}{16}$	.85	.85	.90	1.05	1.40
$3\frac{15}{16}$ - $4\frac{3}{16}$	1.00	1.05	1.25	1.50	1.80
$4\frac{7}{16}$ - $4\frac{11}{16}$	1.25	1.40	1.70	2.00	2.40
$4\frac{15}{16}$ - $5\frac{3}{16}$	1.65	1.80	2.15	2.50	3.00
$5\frac{7}{16}$ - $5\frac{11}{16}$	2.15	2.40	2.75	3.15	3.70
$5\frac{15}{16}$ - $6\frac{1}{4}$	2.75	2.80	3.20	3.85	4.50
$6\frac{1}{2}$ - $6\frac{3}{4}$	3.35	3.50	3.90	4.55	5.25
7 - $7\frac{1}{2}$	3.85	4.20	4.60	5.25	6.00

EXTRAS

KEYSEATING AND SET-SCREWING

Additional charges to regular list prices for gears requiring both keyseating and set-screwing.

Shaft Diameter, Inches	One Set Screw	Two Set Screws
Up to $1\frac{1}{16}$	\$0.40	\$0.65
$1\frac{3}{4}$ to $2\frac{1}{16}$	.50	.80
$2\frac{1}{2}$ to $3\frac{1}{16}$	.60	1.15
$3\frac{1}{4}$ to $3\frac{5}{16}$	.80	1.40
4 to $4\frac{1}{16}$	1.00	1.75
$4\frac{3}{4}$ to $5\frac{1}{16}$	1.20	2.00
$5\frac{1}{2}$ to $6\frac{3}{16}$	1.60	2.80
$6\frac{1}{4}$ to $6\frac{5}{16}$	2.00	3.60
7 and up	on application	

Jaw Clutches furnished on gears, prices on application.

Extra charge for shrouding spur pinions. Prices on application.

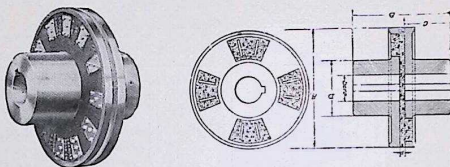
DIMENSIONS OF STANDARD KEYSEATS FOR GEARS

Diam. of Bore (Inches)	Keyseat		Diam. of Bore (Inches)	Keyseat	
	Width (Ins.) E	Depth (Ins.) H		Width (Ins.) E	Depth (Ins.) H
$\frac{1}{4}$ to $\frac{3}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$3\frac{7}{16}$ to $3\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{16}$
$\frac{7}{16}$ to $\frac{5}{8}$	$\frac{1}{8}$	$\frac{1}{16}$	$3\frac{15}{16}$ to $4\frac{3}{8}$	1	$\frac{1}{2}$
$\frac{11}{16}$ to $\frac{7}{8}$	$\frac{3}{16}$	$\frac{3}{32}$	$4\frac{7}{16}$ to $4\frac{3}{4}$	$\frac{11}{8}$	$\frac{9}{16}$
$\frac{15}{16}$ to $1\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$4\frac{13}{16}$ to $5\frac{1}{4}$	$\frac{11}{4}$	$\frac{5}{8}$
$1\frac{3}{16}$ to $1\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{32}$	$5\frac{5}{16}$ to $5\frac{3}{4}$	$\frac{13}{8}$	$\frac{11}{16}$
$1\frac{7}{16}$ to $1\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{16}$	$5\frac{13}{16}$ to $6\frac{1}{4}$	$\frac{11}{2}$	$\frac{3}{4}$
$1\frac{11}{16}$ to $1\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{32}$	$6\frac{3}{16}$ to $6\frac{3}{4}$	$\frac{15}{8}$	$\frac{3}{4}$
$1\frac{15}{16}$ to $2\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$6\frac{13}{16}$ to $7\frac{1}{4}$	$\frac{13}{4}$	$\frac{3}{4}$
$2\frac{3}{16}$ to $2\frac{3}{8}$	$\frac{9}{16}$	$\frac{9}{32}$	$7\frac{5}{16}$ to $7\frac{3}{4}$	$\frac{17}{8}$	$\frac{3}{4}$
$2\frac{7}{16}$ to $2\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{16}$	$7\frac{13}{16}$ to $8\frac{1}{2}$	2	$\frac{3}{4}$
$2\frac{11}{16}$ to $2\frac{7}{8}$	$\frac{11}{16}$	$\frac{11}{32}$	$8\frac{3}{16}$ to $9\frac{1}{2}$	$\frac{21}{4}$	$\frac{3}{4}$
$2\frac{15}{16}$ to $3\frac{1}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$9\frac{9}{16}$ to 10	$\frac{21}{2}$	$\frac{3}{4}$

The above dimensions of Standard Keyways are the sizes used in the manufacture of C. M. C. Gears. However, we can furnish other size Keyways if specified.

Unless otherwise stated there is an additional charge for Keyway.

GRUNDY PATENT FLEXIBLE INSULATED COUPLING



Constructed of three pieces only, the two outer flanges being of Cast Iron, and the center disc of non-conducting material, with lugs on each side for transmitting the power to the outside flanges.

Will give less trouble and will outwear any other flexible Coupling on the market.

Specially adapted for connecting C. M. C. Turbines to Generators and all types of machines.

A simple and effective device for connecting the two ends of Shafting where it is difficult to get the bearings in perfect alignment, or where they are liable to get out of adjustment.

The driving disc, being of non-conducting material, acts as a thorough insulator.

Will transmit more horse-power than any other flexible coupling of equal diameter.

Uneven strains are taken care of.

While maintaining a positive and silent drive, it is free from objectionable hammer action features.

Is perfectly balanced, and adapted for revolving at high speeds.

For Prices and further information send for Grundy Coupling Catalogue.

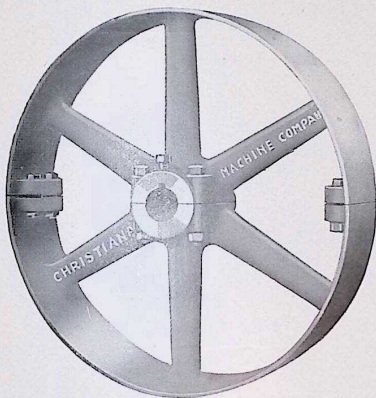
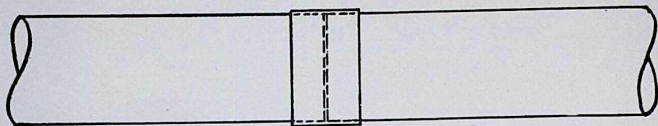


FIG. 501

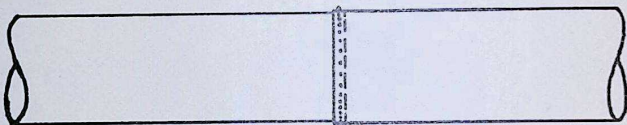
We manufacture a complete line of Cast Iron Pulleys in all sizes, both solid and split including special taper cone, step cone and heavy driving pulleys.

Bored U. S. Standard Gauge, and perfectly balanced.

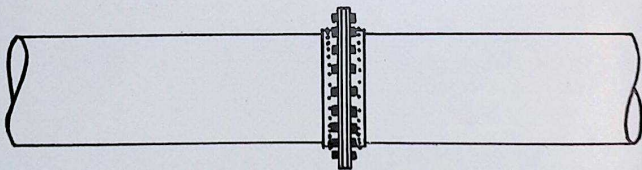
We also manufacture a complete line of Power Transmitting Machinery. Details and prices upon application.



Slip Joint



Riveted Joint



Bolted Flange Joint

We manufacture steel flumes of Keystone Copper Bearing Steel, fabricated in lengths and fitted with Cast Iron Flanges, Gaskets and Bolts or made for riveted joints or slip joints, as illustrated above.

For export or for domestic use, if so desired, our flumes can be supplied punched, rolled and nested, ready for riveting together in the field.

A complete set of riveting tools and necessary rivets are supplied with each order.

Prices on application.

